The Acquisition of Design Skills: A Hybrid Practice in the Digital Age

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How should design skills be taught to those born in the digital age and what role does technological determinism have in this?

Introduction:

Technological determinism posits that technology determines the development of society, culture and values, irrespective of the existing socio-political climate, (Oliver, 2011) while cultural materialism suggests that technologies are developed in response to the context in which it is used. (McKinely, 1981)

Technological determinism is discredited by theorists and academics that think cultural materialism is a more compelling argument. (Williams, 1975; MacKenzie and Wajcman, 1988; Jones, 1988) Prensky (2001) introduced the terms 'digital native' and 'digital immigrant' to differentiate between those born into the digital age (circa 1980) and those born before it. These terms are generalisations, which suggest that technology is responsible for how these people act, think and learn. Despite the terms used, his argument that teaching methods are no longer fit for purpose is one that many agree with (Oblinger and Oblinger, 2005; Helsper, 2009). Policymakers and academics are trying to find a way to provide a more successful learning experience for students born into the digital age. However, this does not mean that what was taught before is no longer relevant, rather that the method for doing so may need to be adapted to integrate digital skills to create a hybrid approach to teaching.

This paper will briefly discuss the debate between technological determinism and cultural materialism by reviewing relevant literature. Auto-ethnography will be used to explore the experience of the author as a digital native and her experience with design education, which will inform her PhD research. This will then be analysed to suggest ways in which design education may continue to develop and improve in an increasingly digital world where educators must ensure that heritage practices do not disappear.

Literature Review

For the following research, there exist two particularly relevant contrasting theories about the relationship between technology and society. These theories are 'technological determinism' (Toffler,1971;Lyotard,2001;McLuhan,2001)and 'cultural materialism' (Williams, 1975; MacKenzie and Wajcman, 1988; Jones, 1988).

Murphie and Potts (2003) explain that technological determinism is both a theoretical position and a popular attitude. The position being a framework that can be used to understand developments in society and the popular attitude being that technology often impacts the daily lives of many in the form of failures which can greatly affect productivity. They say that technological determinism treats technology as it's own entity, which has it's own development and own set of consequences. They define it as the belief that if a successful development in technology is implemented sufficiently it will impact society.

Many argue that well implemented technology does impact society. Havelock (1963) illustrates this when he discusses the importance of technology in bringing the thoughts and ideas of Plato into the 20th century through writing. Eisenstein (1980) also explains the importance of the technology in the form of the printing press in changing the way people learned and developed. Goody (1977) concurs and thinks that technology such as print and electronic media is and will be transformative in the way people think and acquire knowledge. Levy (1997) appraised the digital networking that the Internet has facilitated which he argues will modify the intellectual ecology of society. Conversely, Jones (1988) says that the improvements and mass adoption of the motorcar was not the revolutionary development that it is often made out to be and that it was the economic and political decisions, which made it popular. Therefore it might be argued that all of the above examples, changed society because of their social, economic and political contexts which have not been referred to in the examples.

Jordan (2008) explains that technological determinism is widely discredited because it treats technologies as asocial when any technology can be traced to a societal need. This illustrates that though technological determinism fails as a theory, it does exist where technological failures impact routine and behaviors. However, cultural materialism is a less binary theory that situates technology in its social and political context. Therefore, to teach design skills, it is wise to consider the nuances and non-binary learning approaches of those born in the digital age and consider that a non-binary, mixed method may be necessary to be successful.

Prensky (2001) introduces the terms, 'digital native' and 'digital immigrant'. He uses these to differentiate between those born and brought up in the digital age and those who were born before the digital age. He argues that 'digital natives' think and learn radically differently from how 'digital immigrants' do. He says that this is because they have been networked for almost their entire lives and are not receptive to lectures, step- by-step learning and the vigorous testing culture, which

exists in schools today. Though Prensky supports the idea of technological determinism, his categorization of when people were born in relation to their technological savyness makes an interesting point of discussion and highlights the need to consider that an alternative approach to teaching may be necessary.

Controversially, Prensky poses the question, 'Should the Digital Native students learn the old ways, or should their Digital Immigrant educators learn the new?' (Prensky, 2001). The way he situates these two groups as polar opposites has attracted significant criticism, not least for the way it suggests that the situation is impermeable. Facer and Furlong (2001:467) say that not all those who Prensky may classify as a 'digital native' are comfortable or confident using digital tools and assumptions cannot be made when referring to such a large and diverse group of people. Helsper (2009) argues that this 'distinction is not helpful and could even be harmful.' Educators may assume that a child has relevant digital skills and knowledge, which depends on exposure and experience instead of when a child was born (Facer and Furlong, 2001:467; Helsper, 2009). Additionally, Helsper's research shows that up to the age of 65, people regularly use digital technologies for a vast array of tasks. The difference between the 45-54 age group does not differ significantly from the 18-24 age group (Helsper, 2009). Therefore, to suggest that an educator is a digital immigrant could have a negative impact on their relationship with their students. Furthermore, Helsper (2009) points out that just because a 'digital native' uses the Internet as their first port of call to find information, it does not mean that they can interpret or analyse that information well. This furthers the criticism of technological determinism. It is important not to get caught up in the assumption that those born in the digital age inherently have the skills and ability to use the technology effectively. Considering this pitfall, that children do not necessarily understand the implications or nuances of what they do or learn while using technology, it is imperative to stay vigilant and not make assumptions about ability. Specifically, authentic design skills, which rely on traditional practices are at risk of being diluted by the focus on technical skills, educators may consider combining traditional skills, which teach students how to interpret and design, with digital skills to encourage a productive balance.

These statements and generalisations about the 'techy generation' can further the concept of technological determinism which over-shadows the, perhaps more reasonable, debate of cultural materialism. To suggest that advances in technology have changed the way students learn so dramatically that educators are no longer able to 'speak their language', Prensky (2001), furthers the perceived misconception

that technology changes society independently from economic, social and political factors. Instead it would perhaps be useful to find the social developments, which create the necessary framework for new digital technologies to be widely implemented.

As Prensky suggested, a new method of teaching is necessary to engage with students who are digitally literate. Policymakers are implementing changes; education is embracing the digital to ensure that students learn skills necessary to compete on a global scale (Helsper, 2009). However, due to these changes in general education, which have been implemented in response to the ideas of Presnky and other technological determinists, design education has suffered significantly.

Coorey (2016) says that design educators are torn between teaching theory alongside traditional skills and teaching the relevant technology, whether that is 3D modelling, film editing or image manipulation. Coorey identifies that if educators fail to teach the relevant technology to a high standard, 'a student will struggle to bring their concepts to fruition' (Coorey, 2016: 1). This statement furthers the argument that assumed ability is detrimental to output. A balance is necessary to produce high quality work while maintaining integrity and concept development. The integrity and iterative development is greatly stifled by the desire and expectation to produce highly polished models and designs. In the development process, if work is to be experimental and innovative it cannot be finished to a high standard, at least not authentically, they may be presented well afterwards but are unlikely to have been created like that. Therefore, it is important that educators continue to teach heritage skills in a tactile and experimental way to ensure authenticity. It is important for students to know how to produce a highly polished finished product as it helps others to visualise the concept. Students must be taught these digital skills, but not before learning how to be a designer. Ideas and concepts are not conceived in an organised or step-by-step way. They come quickly and in abundance. Therefore, rough sketching and modeling is a far more appropriate medium for ideation than computer modeling. That can come later, once the ideas have been sketched and modeled and changed several times, then it can be made using CAD. Considering this, it seems appropriate that a hybrid approach be taken to teach design students the skills necessary, whether they are typical digital natives or not.

Technologies change rapidly, which makes some of the learned knowledge obsolete very quickly (Macdonald, 2016). Valuable teaching resources are being wasted teaching students how to use technologies such as CAD software. Educators may struggle to keep up with the changes and therefore the quality of teaching may drop.

This further illustrates the importance that a hybrid approach be adopted. The digital skills may be argued as being ancillary to the traditional skills, in that traditional skills can be a standalone course but if only digital skills were taught the students output is likely to be poorer. Therefore, as long as students are taught how to design and interpret, the time spent teaching CAD may not be wasted even if the skills become obsolete quickly as students will be in a better position to update their skills out of necessity and not at the expense of their ability to design.

Furthermore, considering the theory of cultural materialism, the technologies are contributing to a shift in education. The implementation of neo-liberal policies such as individualization and the consequential economic changes has led to the commodification of education (Karpov, 2013). This has identified what skills are most valuable. Learning CAD to a high level can be easily traced to high paying jobs and therefore CAD and other digital skills may be considered as being of greater value to the economy. (Amiri, 2015; Macdonald, 2016). This highlights the importance of digital skills, though heritage skills may be argued as being core to design education, it cannot be denied that it is important for students to be competent in CAD and other digital technologies. Therefore a mixed teaching approach will be the most effective method, digital technologies change quickly. It will become increasingly important for both educators and students to take responsibility to continually update and develop their own skills. Whereas heritage skills are unlikely to atrophy as quickly.

To instil this agency in students, the teaching of soft skills, such as learning to learn and be effectively critical, software might be deemed as more important than learning specific software. However, due to the increasing commercial need for graduates, fluent in a variety of software programmes, to meet the demands of the growing industry, educators are expected to prepare their students to fill these positions upon graduation. This means that the teaching of digital skills is being afforded more resources, at the expense of traditional skills. A solution to this might be hybridization.

The concept of hybridization of aesthetic, language and expression in design is recruiting an increasing number of academics, educators and practitioners. These include Greiman (1990), Manovich (2007) and Macdonald (2016).

This type of hybridization is the mixing of heritage practices with new digital practices. This may be thought of in its most basic form as a way of mixing images, which were created using different processes. However, Manovich (2007) explains

that it is not just different forms of media, which are being mixed but also different techniques, methods and expressions. This elaboration of the possibilities of hybridization suggests that hybridization encompasses more than the mere aesthetic of a design.

Macdonald (2016: 3) explains why hybridization is important in the preservation of traditional skills. He says, “Now is the time to ensure that heritage skills do not atrophy and wither, but that their qualities and provenance are understood as potent components with digital practices in new hybrids.” He observes that those born in the digital age are keen to challenge the ubiquity of the digital by using analogue practices (2012). These afford the ability to manipulate the result to create endless possibilities for mixing and remixing. As Macdonald explains, students too want to learn traditional skills. Their appetite for it is indicative that traditional practices are intrinsic to the potency of design and that this may be enhanced by the ability to digitally manipulate design to produce new forms, functions and aesthetics.

Greiman is an example of an influential practitioner, educator and academic who, through her work and writing has inspired students and professionals to embrace the hybrid approach. Her examination of typography and colour as subjects in time and space depict the way she mixes technology with graphics (Motrunecs, 1990). This example illustrates that there is a place for hybridity in design and that it has been successful and is attractive to practitioners and academics alike.

It may be argued that in an increasingly mediated, digital world, there is both the expectation and the appetite to rekindle an appreciation for traditional skills and use these in new ways with the digital tools now available. In education, where the need to justify the economic value of skills is having an impact on the skills which are taught hybridization offers a solution. Digital skills, which are perceived as being of high economic value, can be taught alongside traditional skills to form a hybrid. Students will be digitally literate and able to compete in a digital orthodoxy while preserving heritage practices. Additionally, this mix of past and future creates a unique aesthetic with limitless possibilities.

Methodology:

The author can be defined as a ‘digital native’, born in the digital age and confident in using a wide range of digital tools. There is little evidence of any existing literature, which considers a digital native’s experience of design education.

Therefore, a mini auto-ethnography would be considered to be an appropriate method to allow her experiences to be explored in a meaningful way. Jones et al. (2013) explain that there is an absence of real stories from the perspective of the author in academia. Additionally, the experience referred to in the auto-ethnography took place between 2011 and 2014 and so the memories are relatively recent. The mini auto-ethnography presented in this paper is an edited version in order to discuss only what is directly relevant to this research.

A digital native's experience of design education:

I studied product design for three years. The classes were made up of both traditional design classes such as drawing, hand rendering and card or foam modelling and modules aimed at teaching software. The software taught included; Adobe Photoshop and Illustrator in first year; Solidworks and 3DS Max in second year; and Google SketchUp and Arduino in third year.

Now, a few years later, I would consider my Photoshop, Illustrator, Google SketchUp and Arduino skills to be as good as or better than they were at the end of the module. However, my Solidworks and 3DS Max skills have atrophied significantly, to the extent that I would no longer consider myself as having usable skills in either of those software programmes.

On reflection, I notice that the way that the aforementioned software was taught differed.

In first year, our semester was split into two, which meant that approximately six weeks were spent learning Photoshop and the next six were spent learning Illustrator. At the first class we were given a brief demonstration of some of the most commonly used tools from each program. We were to design a visual layout for the BBC news app in Photoshop and then a poster for a holiday destination in Illustrator. There was a PhD student teaching assistant who was there during the classes to give anyone help if they needed it. Apart from that though, we were left to explore the software.

In second year we were taught to use Solidworks first and then 3DS Max. In each of these modules we were given tasks to complete. For Solidworks, we were to copy a blender; we measured the blender, took angles and learned how to use the software to produce an exact replica of the casing of the blender. One thing that the lecturer said which I still apply to my work today is, "Don't let software limitations limit your

design potential. If you can't get the software to do what you want, learn how or use a different software if it's not possible." In 3DS max we were given the task of designing a wheel, which could then be animated. In this case, as a whole class we sat on our laptops and followed the step-by-step instructions from the screen to create our own, identical wheel that appeared to turn on-screen.

In third year we learned to use Google SketchUp and Arduino. In the case of Google SketchUp, the lecturer took the same approach as we had been taught with in first year. We had to design a temporary street booth, which might sell newspapers or flowers. In this case, were left for four weeks to design and explore the software alone. However, when we were taught to use Arduino software and hardware, the lecturer spent the first lesson going through some basic coding and showing us how to wire the Arduino to use various components such as LEDs, resistors and sensors. This was similar to how 3DS Max was taught in second year. After this introduction though, the classes for the rest of the module were less structured and allowed for more creative freedom and exploration. The lecturer curated our learning by setting us the task of using a variety of predetermined components to create small interactive design projects for the following week.

Analysis:

The way that Photoshop, Illustrator and Google SketchUp were taught followed a 'just- in-time' educational model, which Gershenfeld (2007) describes as teaching what needs to be learned as and when it arises instead of the 'just-in-case' model which teaches a predetermined curriculum which educators hope will include things which may be useful later. The 'just-in-time' method has repeatedly been acknowledged as being important when learning something new. (Montessori, 1964; Schank, 1995; Macdonald, 2016) Although the setting of particular assignments might be construed as non- constructivist, in a formal education context it is difficult to ensure some success is achieved and therefore the assignments might be considered as the curation of learning, not the dictation.

The hybrid approach used to both learn and teach Arduino combines the more traditional teaching methods as illustrated in the learning of 3DS max, the 'just-in-case' model with the 'just-in-time' education model that Gershenfeld (2007) discusses. In a time of change where educational policy cannot always respond quickly to innovation, this hybrid approach may allow more freedom within teaching. This ensures that students learn what they need to, to satisfy policies but they also have the freedom to apply this knowledge in unique and creative ways.

Additionally, due to the freedom afforded to them, when learning these skills students were able to improve their design thinking, ideation and develop their style and intuition. Although the creation of digital files in the software did not require much traditional hand skills beyond some sketches, the ability to develop concepts and professional instinct can be argued as being part of the traditional design skillset. Therefore, this can be considered as being a form of conceptual hybridization, essential in sustaining traditional skills.

The lack of fixed learning objectives is akin to Prensky's theory of edutainment. He poses that the best way for 'digital natives' to learn is through a computer game, which he says is a natural environment for the 'natives'. (Prensky, 2006) He mentions the game Monkey Wrench, which was used to teach engineers how to use complex CAD software. Although he admits that there have been few successful examples of edutainment. (Prensky, 2001) Despite the lack of widespread success, this further reiterates the acknowledgement that the rigid learning methods of the past are no longer appropriate. However, just because learning methods are no longer appropriate, it does not mean that processes used in design practice are no longer appropriate, instead it may be more important than ever to continue using traditional processes to ensure their longevity.

Solidworks and 3DS Max were taught by different lecturers and so the impermanence of these skills cannot be attributed to the teaching style of a specific lecturer. Additionally, it may be suggested that these software are more complex than the others and therefore, to maintain the skill it might be necessary to practice it regularly. The 'step-by- step' or 'just-in-case' learning model is discussed by Prensky (2001). He describes it as being unsuitable for 'digital natives' and therefore it can be argued that this style of learning is no longer suitable, especially not for those born into the digital age no matter the complexity of the software, unless it is used as a precursor to the 'just-in-time' model to form a hybrid learning experience.

Finally, the quote from the lecturer who taught Solidworks, about not letting the limitations of software dictate design can be viewed as a being opposed to the technological determinist position. This educator was empowering the students to ensure that they did not betray their integrity as designers by succumbing to the software.

Findings:

Learning through doing, when learning software not only makes the skills last longer, but they also encourage design intuition, which is essential for the professional. Perhaps only conceptually, this too is evidence of hybridization, taking parts from the traditional skill set and using this for digital file creation. As Macdonald (2016) argues, designers can learn technical skills but they also have to develop an attitude and way of working which will allow them to solve problems and work beyond what they are comfortable with.

Presently, there is a strong hybrid aesthetic in graphic design as traditional images and footage can be digitally manipulated to create a bricolage of the traditional and the digital. However, product design has not yet been democratized to the same extent as graphic design and therefore a hybrid aesthetic of the traditional and the digital has not really made its way into product design. However, with micro-manufacturing tools such as 3D printers becoming more affordable and accessible there is now the opportunity to have this new aesthetic alongside the conceptual hybrid, which will ensure that traditional handcraft skills such as model making are not lost. The 3D printing education service, Wee Replicators, run by the author, is experimenting with this by using plasticine and a 3D scanner. Their 3D scanner is basic and made from an Arduino and by hacking a standard webcam and laser pen. Thus, it shows that this is a very affordable method of hybridization. Wee Replicators works mainly with children. The children can make a model out of plasticine, 3D scan it and then 3D print their design. (Figures 1-4) All of which can be done relatively quickly allowing as many iterations of their design as they like. Though Macdonald (2016: 39) did not necessarily mean it literally when he said, “the mark of the designer is evident” when referring to digitally produced hybrids, in the example from Wee Replicators, the mark of the designers and makers is evident in the way their fingers imprinted the plasticine and are then carried forward into the well finished 3D printed object which represents a manufactured artefact. These marks show that a human made the object and that though they may not be intentional, they convey the imperfect, but beautiful process of traditional handcraft.

Figure 1 Plasticine model (Wee Replicators, 2016)

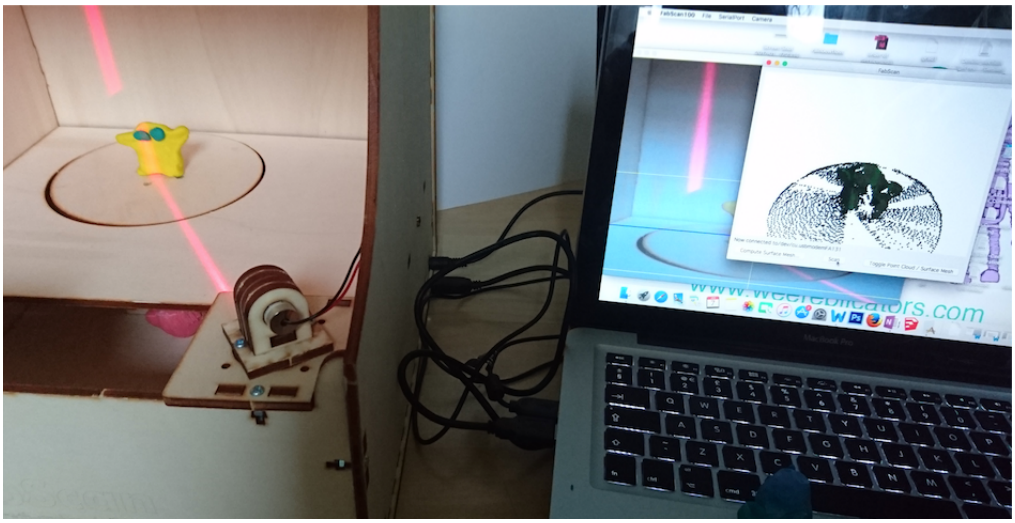

Figure 2 Plasticine model being 3D scanned (Wee Replicators, 2016)

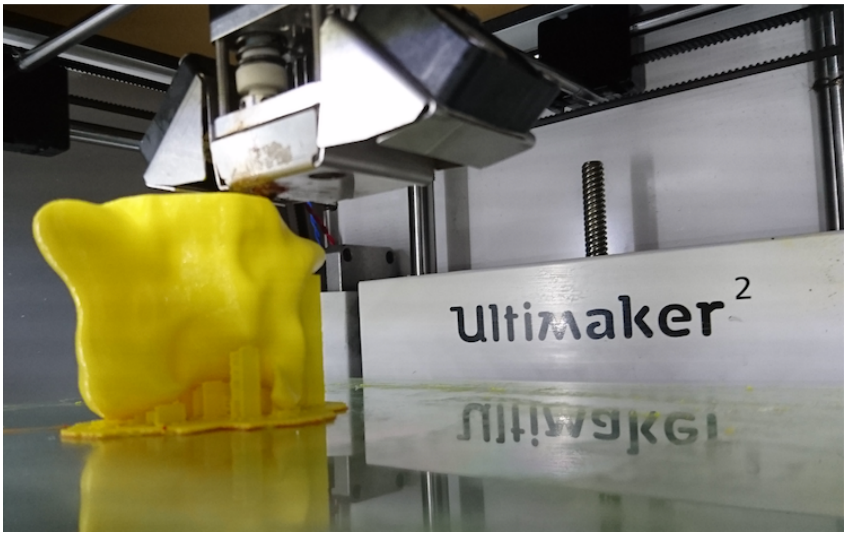

Figure 3 Digital file created from 3D scan being 3D printed (Wee Replicators, 2016)

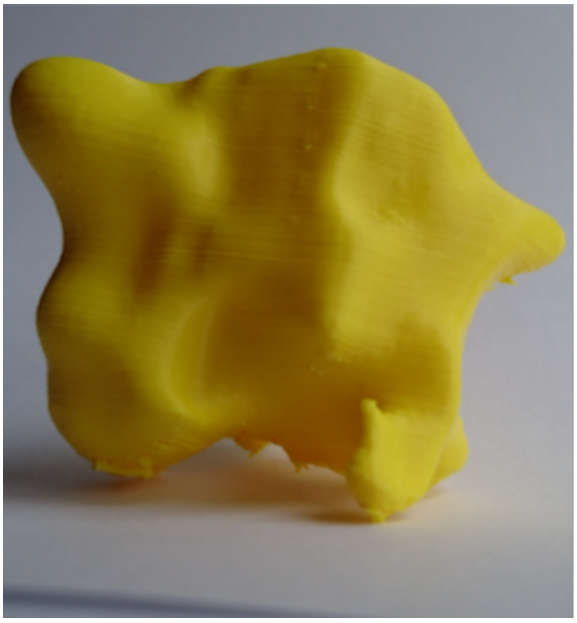
Figure 4 Finished artefact, with evidence of the maker in the form of indents and imperfections. (Wee Replicators, 2016)

Therefore, from a pedagogic standpoint, perhaps software skills should be taught using a less structured approach to allow for more creative freedom and exploration so that students learn the software for themselves, which as has been suggested in the auto- ethnography, may make the skills more meaningful and therefore last longer. Additionally, Macdonald (2016) says, those born into the digital age are

curious and eager to explore traditional processes due to their tactile qualities and the time they allow for creative thought and experimentation. Therefore, perhaps model making beyond just plasticine, to include card, foam and even wood could be used as the basis for a digital file, which can then be altered using CAD software. Currently, digital fabrication tools such as 3D scanners and 3D printers are limited in their abilities. However, they will continue to improve and become easier to use with better results. When this happens, students and practitioners can be ready to exploit the technology to create beautiful and innovative designs combining both heritage practices and digital skills.

Design and design education is pushing the development of technology so that it can better serve the industry, it is dictating what it needs in order to develop and innovate. To suggest that technology is determining the capabilities of design is misguided, it is design that is pushing technology to accommodate its own requirements.

Conclusion:

With the economic pressures on art and design education, digital skills are being allocated more resources in place of traditional skills. Educators must ensure that their students are digitally literate and confident in using an array of software. However, it may be argued that the desire to provide students with a range of complex software skills has led to the adoption of methods, which teach students a process in a way that is not authentic. Furthermore, from the auto-ethnography and evidence from the work of others (Gershenfeld, 2007), learning software by exploration might be a way in which students can acquire authentic skills, which will not atrophy. Additionally, hybridization can bridge the design skills from the past with design skills from the present and future. This will allow design education to present itself as being valuable to the economy, which will attract funding, while maintaining it's integrity and authenticity. The hybrid aesthetic has already been embraced in graphic design. However, in product design it is yet to make a significant impact. The work of some including that of Wee Replicators, propose how the hybrid aesthetic might infiltrate the industry. Macdonald (2016:38) says, "We seek to embrace a pluralistic approach that accommodates the sleek and perfected solutions but also the sublime accidents, the contaminated and the hybrid."

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